REMARKS

In the Office Action, claims 8, 10-14 and 16-26 are rejected under 35 U.S.C. §103. Claims 27-32 have been withdrawn due to a previous restriction requirement. In response to the Office Action, and in accordance with the telephonic interview courteously granted on November 4, 2005, claims 8, 14 and 21 have been amended herein. In addition, a petition for a one-month extension of time is submitted herewith. A check in the amount of $120.00 is submitted herewith to cover the cost of the one-month extension. Please charge Deposit Account No. 02-1818 for any insufficiency or credit. Applicants believe that the rejections are improper or been overcome for at least the reasons below.

In the Office Action, claims 8, 10, 14, 16-18, 20, 21 and 26 were rejected under 35 U.S.C. §103(a) in view of U.S. Patent No. 6,589,682 to Fleckner et al. ("*Fleckner*") and U.S. Patent Application No. 2003/0203139 to Ren et al. ("*Ren*") as evidenced by U.S. Application No. 2003/0048057 to Oyama et al. ("*Oyama*"). Therefore, the Patent Office relies primarily on *Fleckner* and thus relies on *Ren* and *Oyama* to remedy the deficiencies of *Fleckner*. With respect to *Fleckner*, this reference is clearly distinguishable from the claimed invention, as discussed during the November 4, 2005 telephonic interview.

Of the pending claims at issue, amended claims 8, 14 and 21 are the sole independent claims. Amended claim 8 recites a gas diffusion electrode operable within a fuel cell having a proton conductor, wherein the gas diffusion electrode is adhered directly to the proton conductor and consists essentially of a fibrous carbonaceous material, wherein the gas diffusion electrode comprises a thickness ranging from about 2 μm to about 4 μm. Amended claim 14 recites A fuel cell, including a first electrode and a second electrode facing the first electrode; and a proton conductor disposed between the first electrode and the second electrode, wherein at least one of the first electrode and the second electrode is adhered directly to the proton conductor and consists essentially of a fibrous carbonaceous material formed on the proton conductor, and wherein at least one of the first electrode and the second electrode comprises a thickness ranging from about 2 μm to about 4 μm. Amended claim 21 recites a fuel cell including a first electrode, a second electrode, and a proton conductor disposed between the first electrode and the second electrode, wherein at least one of the first electrode and the second electrode is adhered directly to said proton conductor and consists essentially of a carbonaceous material selected from the

group consisting of at least one type of carbon nanotube, a graphite fibrous material, and mixtures thereof, and wherein at least one of the first electrode and the second electrode comprises a thickness ranging from about 2 μm to about 4 μm. Support for the amendments can be found, for example, at page 8 of the specification.

In an embodiment, using the carbonaceous material described above, the fuel electrode or the oxygen electrode may be formed directly on the electrolyte film by, for example, a spraying method, a dripping method, or other like process. See, Specification, pg. 7, lines 13-15. Thus, an agglomeration of the carbonaceous material may be adhered on the proton conductor film. See, Specification, pg. 7, lines 20-21. In this regard, it is not necessary to separately handle the fuel electrode and/or the oxygen electrode and thus the mechanical strength of the electrodes does not have to be taken into consideration. Therefore, the electrodes may be reduced in thickness. This can enhance the cell reaction and improve cell performance. See, Specification, p. 2, lines 19-26 and pg. 7, lines 29-32. Additionally, the electrode obtained by directly forming the carbonaceous material by the spraying or dripping methods described above can exhibit superior adhesion to the electrolyte film, while reducing the risk of peeling or removal therefrom. See, Specification, pg. 8, lines 2-5.

Applicants believe that *Fleckner* is deficient with respect to the claimed invention for at least a number of reasons. *Fleckner* does not disclose or suggest that the gas diffusion electrode consists essentially of a carbonaceous material, such as a fibrous carbonaceous material, that is directly adhered to the proton conductor material, as discussed with the Examiner during the November 4, 2005 telephonic interview. In contrast, *Fleckner* discloses a catalytic electrode layer that is sandwiched between the GDL and the proton conductor. See, *Fleckner*, col. 5, lines 57-66. *Fleckner* appears to disclose a press fit arrangement where casing components 36, 38 are fastened together by a series of torquing bolts 40 and 41 to exert pressure on the interior fuel cell components. See, *Fleckner*, col. 5, lines 29-39. Moreover, *Fleckner* lists additional ways in which the GDL may be formed, none of which suggest adhering the carbonaceous material directly to the proton conductor. For example, one disclosed method of forming the GDL provides that aligned arrays of fullerenes can be adhered to the surfaces of the flow field plate (FFP). See, *Fleckner*, column 6, lines 53-56. Alternatively, the GDLs can be fabricated by affixing the nanotubes to a conventional, porous GDL material such as Teflon-impregnated

carbon paper, an aerogel or a carbon fibermat. See, *Fleckner*, col. 7, lines 1-5. Nowhere does *Fleckner* suggest that the GDL may be adhered to the proton conductor.

Applicants have advantageously discovered that the fibrous carbonaceous material can be directly formed as one or both of the fuel and oxygen electrodes on the proton conductor, and thus, separate handling of the fuel and/or oxygen electrodes is not required. Moreover, Applicants have demonstrated that a fuel cell that incorporates the electrodes has a superior performance, such as an output of approximately 100 mW, 0.6 V, and further can be more easily manufactured by adhering the fuel and/or oxygen electrode directly on the proton conductor. See, Specification, page 7, line 29 to page 8, line 5.

Moreover, *Fleckner* fails to even mention the thickness requirements of the alleged gas diffusion electrode (100, 102) as even admitted by the Patent Office. See, Office Action, page 2. Indeed, Applicants have discovered that the fuel electrode and oxygen electrode are not required to be independent films, and thus, are not required to exhibit mechanical strength. In this regard, the thickness of the electrodes can be extremely thin, such as from about 2 μm to about 4 μm. In contrast, *Fleckner* emphasizes the need for the GDL to exhibit improved mechanical strength. *Fleckner* notes that "one of the advantages of using fullerenes to deliver fuel and oxidizer to the catalytic electrodes of the [alleged] novel fuel cells disclosed herein is that of greater structural rigidity." See, *Fleckner*, col. 6, lines 60-64. *Fleckner* goes on to say that the GDLs are susceptible to crushing, and that the aligned nature of the nanotubes helps prevent crushing. See, *Fleckner*, col. 7, lines 5-7. Therefore, *Fleckner* teaches away from the desirability of creating ultra thin GDL layers because they are susceptible to crushing and require increased structural rigidity. Thus, Applicants believe that *Fleckner* is clearly distinguishable from the claimed invention for at least these reasons.

Further, Applicants do not believe that the remaining cited art relied on by the Patent Office in support of *Fleckner* can be utilized to remedy the deficiencies of same. Assuming arguendo that *Oyama* can even be asserted as prior art, which Applicants question, the Patent Office merely relies on *Oyama* for its alleged teaching regarding a fibrous carbon material. See, Office Action, page 4. Moreover, the Patent Office only relies on *Ren* for the purported teaching of manufacturing carbon nanotubes by chemical vapor deposition. Therefore, even if properly combinable, *Fleckner*, *Ren* and *Oyama* do not disclose or suggest a gas diffusion electrode

operable within a fuel cell having a proton conductor, wherein the gas diffusion electrode is adhered directly to the proton conductor and consists essentially of a fibrous carbonaceous material, wherein the gas diffusion electrode comprises a thickness ranging from about 2 μm to about 4 μm.

Based on at least those reasons above, Applicants believe that *Fleckner*, *Ren* and *Oyama*, even if properly combinable, are distinguishable with respect to the claimed invention.

Accordingly, Applicants respectfully request that the obviousness rejections with respect to claims 8, 10, 14, 16-18, 20, 21 and 26 be withdrawn.

In the Office Action, claims 11-13, 19 and 22-25 are rejected under 35 U.S.C. §103(a) in view of *Fleckner*, *Ren* and U.S. Patent No. 6,013,371 to Hager et al. ("*Hager*"). The Patent Office merely relies on *Hager* for the teachings of same as they purportedly relate to carbon fibers enhancing the mechanical performance of a carbon-carbon composite. *Hager* fails to provide an electrode adhered directly to a proton conductor. As previously discussed, independent claims 8, 14 and 21 have been amended to recite, in part, that the electrode is adhered directly to the proton conductor. Therefore, *Hager* fails to remedy the deficiencies of *Fleckner* and *Ren* for at least this reason. Moreover, *Hager* reference fails to provide the thickness of the gas diffusion electrode for use in a fuel cell.

Based on at least those reasons above, Applicants believe that the cited art, even if properly combinable, is distinguishable with respect to the claimed invention.

Accordingly, Applicants respectfully request that the obviousness rejections with respect to claims 11-13, 19 and 22-25 be withdrawn.

For the foregoing reasons, Applicants believe that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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Dated: November 14, 2005